BIG CREEK REGION CONSERVATION REPORT

LAND

ONTARIO DEPARTMENT OF PLANNING AND DEVELOPMENT

CONSERVATION BRANCH

BIG CREEK REGION

CONSERVATION REPORT

LAND

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AUTHORSHIP

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RECOMMENDATIONS
STATED OR IMPLIED IN THIS REPORT

1. That the future prospects of the Upper Black Creek area should be considered primarily in terms of agriculture and steps should be taken now to preserve and improve the base on which this type of economy will rest. p. 25

2. That those desirable changes in land use which demand the application of technical experience, a longer period of years to accomplish, or a greater outlay of funds than are at the disposal of the farmer might become wholly or partly the Authority's responsibility. p. 15

3. That the Authority should promote land use planning on farms. p. 44

4. That the Authority continue its interest in farm ponds p. 47

5. That because the regulation of permanent streams by structures is subject to statutory regulation, the matter may be a legitimate concern of the Authority. p. 26

6. That the Authority assist, where desirable, in the construction of grassed waterways. p. 46

7. That sand dunes are usually unstable and are best covered by trees and permanent grass. p. 10

8. That action should be taken to control streambank gullies before they become a serious problem. p. 45

9. That some of the badly gullied and eroded steep slopes should be reforested. p. 22

10. That the permanent woodlands should be improved and the grazing of them restricted. p. 25

11. That the Authority should publicize the services provided by various agencies which are available to farmers. p. 44

12. That the Authority might publicize the advantages of adequately installed tile drainage. p. 47

CHAPTER 1

THE FACE OF THE LAND IN THE BIG CREEK REGION

1. Introduction

The Big Creek Region includes all or part of five counties - Norfolk, Elgin, Oxford, Brant and Haldimand - and 14 townships. There are several towns and villages - Simcoe (8,005), Delhi (3,018), Port Dover (2,722), Waterford (1,863) and Port Rowan (768) - and many hamlets.*

In addition to the Big Creek itself, there are a number of other streams in the region, including Clear Creek, Dedrich Creek, Lynn River and Nanticoke Creek. These and many more small ones flow into Lake Erie. There are natural pondings within the watershed but few are of sufficient size for recreational or other extended use. At best they are suited to stock watering and, perhaps, irrigation. There are, of course, a number of constructed mill and other ponds such as those at Waterford and Simcoe.

At its widest the region extends about 37 miles east-west. The north-south dimensions are about the same. The Big Creek Region covers an area of approximately 614 square miles, or 393,000 acres.

In altitude the area ranges from about 575 feet at the lake to about 1,100 feet in the moraine to the north-west. Most of the land is under 800 feet elevation. The slope of most of the sand and clay plain is quite shallow and the morainic ridges rise above them 50 to 75 feet.

2. Bedrock Geology

The backbone of Ontario is rock, either stratified waterlaid sediments which, through millions of years, have become cemented by chemistry and time, or igneous rocks. In the former group are the shales, limestones and sandstones,

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* Population figures from 1957 Municipal Directory, Department of Municipal Affairs.

and in the latter group the granites and other plutonic materials. Most of Southern Ontario is underlain by sedimentary strata, which, in turn, are underlain at great depth by plutonic rocks. The latter are those common to the Canadian Shield.

In most of the bedrocks of Southern Ontario three major periods of geologic time are represented - the Ordovician, the Silurian, and the Devonian. The Ordovician rocks are found east of the line connecting Collingwood and Hamilton. They are separated from the western portion of Old Ontario by the prominent Niagara escarpment. The Silurian rocks occupy a band of country running from the Niagara River westerly to Woodstock - Hamilton and thence north to Bruce and Manitoulin. The Devonian rocks occupy the balance of the country west to Lake Huron and the Detroit River. The division between the Devonian and Silurian systems is marked by the Onondaga escarpment which may be seen between Fort Erie and Hagersville, beyond which it is covered by later deposits of glacial till and lacustrine materials. Each of the above systems is composed of a number of formations, which may contain several strata of possibly different rocks.

Nearly all of the Big Creek region is underlain by the limestones of the Onondaga formation. A small area, particularly in Burford Township, is underlain by Silurian rocks of the Salina - Bertie - Akron formations. These contain bits of shale, dolomite, salt and gypsum. The latter are confined to the Salina.

Except in the eastern portion of our area the bedrocks are thickly covered by a mantle of drift which ranges from 50 feet or less in thickness in the eastern portion of the watershed to 300 feet in thickness at Port Rowan. Outcrops of cherty Onondaga limestone are found in a few places - Villanova, Rockford, No.3 Highway east of Renton and to the south of this place, and in a small valley east of Tyrrell.

The rock has been quarried in several places but this development has not been significant.

In the area as a whole, the bedrocks are of little importance. They offer no impediment to agriculture or construction. The well waters they provide, if fresh, are often hard. Many are not potable because of sulphur content. The sands of the Norfolk plain may be 50 feet or more thick over compact till or other, stratified, materials. They provide good water supplies with minimum difficulty.

3. Climate

The climate of this part of Ontario may be described fairly well from the weather records of the several recording stations in the locality. A better understanding of the regional climate may be had, however, only after recourse to the statistics covering a much wider area.

Most of the Big Creek Region watershed lies within a climatic region called by Putnam and Chapman the "Lake Erie Counties"*. Nearly all of the sand plain and the southern portions of some of the moraines lie within this region. The northern section of higher elevation belongs to the region described as the "South Slopes".

The Lake Erie Counties climatic region varies in width and extends from Toronto on the east to Lake Huron on the west. Its northern boundary extends south-westward from Toronto through Dundas to near Tillsonburg, and thence north-westward to reach Lake Huron south of the Huron-Lambton county line. The region occupies all of the land south of this line with the exception of that belonging to the Niagara Fruit Belt and the area west of Ridgetown - Sarnia. The South Slopes region extends from western Middlesex to Frontenac County.

Putnam and Chapman have described these two regions as follows:

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* Putnam, D.F. and Chapman, L.J. The Climate of Southern Ontario. Scientific Agriculture 18:8, April, 1938.

Lake Erie Counties

"This region, bounded by Lake Erie on the south, Lake Ontario to the east and Lake Huron to the west, has a climate modified by the influence of these lakes as shown by the mean daily range of temperature, frost dates and length of growing season. Although having a warm, early season it is not quite so well favored as the three regions previously outlined. It is an area of gentle relief, varying in elevation from about 600' to slightly over 800', the most prominent features being the crests of some of the glacial moraines.

"Except in the Niagara Peninsula, the northern boundary is formed by the annual isotherm of 45°. Winter temperature ranges from 23° to 24°, Spring temperatures are about 43°, with 42° along the northern border and also along the shore of Lake Erie. Summer temperatures average about 67° with 66° along Lake Erie. Fall temperatures vary from 48° to 50°, being warmer along the lake shores. The extreme low temperatures range from -21° to -35° and the highest temperature ever recorded is 106°. The frost-free period varies from 160 to 135 days, depending on the distance from the lakes. On the other hand the growing season has a fairly uniform length of about 200 days from the middle of April to the first week in November.

"The average precipitation is 33.8 inches, but is heavier in Norfolk, Elgin and Middlesex and lighter both to the east and west. The normal snowfall varies from 40 to 90 inches in the same manner. The growing season receives slightly over half the precipitation. The P-E index for the three summer months ranges from 10.5 to 13.5. The drought frequency is about 20, strangely enough, being higher in the areas receiving greater precipitation. The greater rainfall in the central part of the region is not apparent because of the sandy soils."

The South Slopes

"To the north of the Lake Erie region and the Lake Ontario shore there is a belt of country with a southern exposure, in which the climate is somewhat milder than that of the regions to the north, but which does not enjoy the modification of the lake influence to the extent of the first-mentioned areas. In altitude, most of the area ranges from 500 to 1000 feet above sea level.

"The mean annual temperature ranges from 43° to 45°. The winter isotherms of 18° and 19° approximate the northern boundary and in some parts 23° is reached. The spring mean ranges from 41° to 42° at most stations and is similar to that of the Lake Ontario shore; the summer mean of 66° is also similar. The fall temperature mean of 47° is intermediate between that of the lake regions and that of the Western uplands. The temperature extremes at the various stations are: low, -27° to -39°; high, 101° to 105°; the greatest range at any one station being 143°. The mean daily range of 19° is wider than that of the shore regions but similar to much of the territory to the north. The average length of the frost-free period ranges from 133 to 147 days, from May 11 to 20 until September 28 or in some places October 3. This is from one to two weeks longer than the central part of the uplands and

certain parts of Simcoe county. The growing season of 192 to 200 days is similar to that of the Lake Erie and Lake Ontario regions but definitely longer than that of the regions to the north.

"Annual precipitation varies from 32 to 38 inches, with a little less than half falling between April 1 and September 30, and from 7.0 to 9.6 inches in June, July and August. Snowfall varies from 50 to 90 inches."

There is some correspondence between the northern boundary of the Lake Erie Counties region and that of Halliday's Deciduous Forest Region*. The latter notes that this region, because of favourable climatic and soil conditions, allows "for the sole distribution in Canada of many Deciduous Forest species". He also observes that "a large number of these species find their northern limit here".

There is perhaps no particular climatic control governing the growth of agricultural crops from one region to the other but there is no doubt that for some crops at least some varieties will fare better in one zone than in another. Length of time to maturity, length of frost-free season and length of growing season are important factors respecting variety suitability. Crop varieties should be selected with reference to climatic conditions in order to obtain the best yields. At least one crop, peaches, is restricted to the lakefront, chiefly because of the more equable climate found there.

4. Physiography

During the past million years, Southern Ontario has been covered at least three times by major, continental glaciers. The last of the ice, that of the Wisconsin glaciation, vanished from the Big Creek region perhaps no longer than 15,000 years ago. Each of these major ice advances was marked by many minor, often local, fluctuations in the ice front.

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* Halliday, W.E.D. A Forest Classification for Canada. Department of Resources and Development, Forest Research Division, Ottawa, Bulletin 89, 1937.


OXFORD E.
BURFORD
TOWNSEND
POINT BAY
PHYSIOGRAPHY
—LEGEND—
SAND PLAIN
UNDRUMLINIZED TILL PLAIN
TILL MORAINE
MUCK AND PEAT
CLAY AND SILT PLAIN, ERODED SLOPES AND BOTTOM LANDS
BEACHES AND SHORECLIFFS
MAP BASED ON "CHAPMAN AND PUTNAM THE PHYSIOGRAPHY OF SOUTHERN ONTARIO", COUNTY REPORTS OF THE ONTARIO SOIL SURVEY. SURVEY WORK BY THE ONTARIO DEPARTMENT OF PLANNING AND DEVELOPMENT

The sedimentary bedrocks outcrop in only a few places in the eastern portion of the watershed. In the past they have been quarried to a small extent.

The ground-waters are often highly sulphurous as at this spring near Delhi.

Nearly all of the present-day topography of the area stems from the activity of the Wisconsin ice and particularly of the fluctuations affecting it before it finally withdrew. Coincident with the ice recession, resulting from climatic amelioration, there came vast outpourings of glacial meltwaters. These were dammed up to form extensive glacial lakes by the as yet unmelted ice and by the new lines of hills created by the ice. These lakes were important in the creation of extensive level plains of sand, silt and clay which are common in the region and over much of Ontario.

The glaciations of pre-Wisconsin age are of small significance in the Big Creek area, particularly in the eastern section where the drift is thin. Westward they may be more important in providing aquifers and impermeable layers useful in the supply of potable water. Perhaps, too, some of the moraines have formed over pre-Wisconsin deposits.

Several types of glacial landforms may be recognized in the Big Creek region. Those moulded by the ice itself include the till moraines and till plains. The meltwaters off the ice carried tremendous loads of material and these glacial rivers, debouching into the lakes and dropping their sediment load, gave us the sand, silt and clay plains which we see today. Associated with these glacial lakes were shorelines and lines of sand dunes. Post-glacial activity has given us the present drainage pattern, the peat and muck deposits, the present variety of soils, and the bluff cut by Lake Erie. The spits of Long Point and Turkey Point are creations of Lake Erie.

During the general retreat of the ice sheet the Erie lobe (occupying and spreading out from the Lake Erie basin) was probably of most importance in building much of the watershed scenery. Over a period of time it advanced and receded several times, from and to the general area of present Lake Erie, and in the course of each advance or retreat constructed several moraines. Reading west to east these are the

St. Thomas (Mt. Elgin Ridges), Norwich, Tillsonburg, Paris and Galt moraines. Portions of these moraines were either constructed under water or were later covered by lake waters and smoothed. Within the watershed the Paris and Galt moraines are sandier than the others. The terminal stretches of several of the moraines have been covered intermittently by deltaic sands and a beaded aspect produced with the higher portions protruding above the sand.

The moraines are long, knobby ridges built up of glacial till, an unconsolidated, unstratified mixture of clay, sand and irregularly-shaped stones and boulders. The till of a moraine may range from coarse and bouldery to heavy and largely stonefree, and, except for the Paris and Galt, which are sandier, the moraines are more like the latter. The irregularly-shaped depressions between the knobs are frequently poorly drained and may contain peat or muck deposits.

The heavier, relatively stonefree soils of the moraines belong to the Huron catena. The soils of the Guelph catena have developed on the somewhat stonier, lighter tills where these occur. The well-drained members of both catenas are fairly fertile but subject to erosion when cultivated. They are unsuitable for the production of flue-cured tobacco but are highly satisfactory for general, beef and dairy farming and for some cash cropping. There is often decided contrast between the rural landscape on the moraines and that on the sand plain.

The till plain occupies only a small area and is confined to the north-west section of the watershed. While the general aspect is similar in many ways to that of the moraines the topography is more subdued and the slopes are longer and not so steep. Drainage imperfections are often widespread. A till plain is formed under a moving mass of ice, rather than at the perimeter of a lobe as is the case with a moraine. In this area the land use is much like that

found on the moraines. Perhaps the chief conservation problems involve drainage and fertility improvement.

Coincident with the recession and stagnation of the ice there came vast outpourings of meltwaters through the spillways in the Guelph and Brantford areas. At the same time large glacial lakes were created. Two of these, Warren and Whittlesey, occupied more or less the same area at different times and are of particular significance to this area. At the time of Lake Whittlesey the present Lake Ontario basin, the Niagara Peninsula, and the eastern portion of the Lake Erie basin were ice covered. The Huron lobe overlapped the boundaries of the present Huron basin, and the central portion of Western Ontario was dry land. The southward-flowing meltwaters carried immense amounts of sand which were deposited in Lake Whittlesey to form, subsequently, the Norfolk sand plain. A large volume of sand was also deposited later in Lake Warren. As noted previously, portions of some of the moraines were wholly or partially buried by the sands, and, of course, the sands completely cover, often to considerable depth, the till sheets originally formed by the ice. Where the sand is shallow, imperfect or poor drainage is common.

The sands do not rate highly for dairying or general farming because their inherent fertility is low; they are often inclined to be droughty, and because of the low organic content and the rapidity with which nutrients are leached out. When regularly cultivated and not protected they become subject to wind erosion. These soils have, however, proved very suitable for the production of bright-leaf tobacco. So suitable were they that the 1954 crop ranked second in gross value in Ontario after hay and clover. Some 120,800 acres of land were used for this crop, with a production value of $74,174,000. Because of drought, disease and frost, the 1955 crop was smaller. Not all of the crop is

grown on the Norfolk plain, of course, but the bulk of it is produced there.

The sands have also been used to advantage for the growth of orchard crops such as peaches and apples. There has been considerable development of this kind along the lakefront in Houghton Township (particularly in peaches), in Charlotteville Township near Walsh and Vittoria, and in Townsend and Woodhouse Townships east of Simcoe. Various other small fruits and vegetables are also grown on the sand and clay plains to supply the factories at Simcoe. The orchard crop production appears to be localized because of a happy climatic factor or because of suitable soil conditions. Many orchards are situated on the transition zone between the sand and the heavier soils. Good drainage with an adequate moisture supply would appear to be important. There seems no doubt that a considerable suitable acreage exists for future expansion.

The soils of the Norfolk plain are generally quite permeable. This, coupled with the more impermeable layer of clay or till at depth, serves to provide the region with an adequate and potable water supply. Also much of the sand is shallow over clay or till and farm ponds for various uses are easily made. Indeed, these thousands of acres of shallow sand are often imperfectly or poorly drained and the land is usually not suitable for the production of tobacco and orchard crops in its natural state. Large areas are covered by unimproved bush or scrub or, if cleared, are often left idle. Some of the land is used to pasture the horses necessary in tobacco harvesting.

The glacial lakes, of which Warren and Whittlesey were most important in this area, persisted for some time and as a result there developed wave-cut bluffs, beaches and off-shore bars. These features are like those found along the Lake Erie shore but are often not as well developed.

The physiographic map reveals some of the major shorelines. Where the wave-cut materials are stony, boulder terraces may have developed.

There are also many dunes through the area. The more extensive belt-like developments relate to the glacial lakes. One line runs north of Langton and another west of Simcoe. The former, Putnam and Chapman suggest, may be referable to Lake Warren. Dunes are also found elsewhere and some of the smaller developments are no doubt a result of wind erosion since settlement and land clearing. Dunes are rather unstable and consequently are often unsuited to cultivation. They are best covered by trees or permanent grass; many have been reforested.

Much heavier soils are found in the eastern portion of the watershed and in the area surrounding Port Rowan. Principally these are clay plains but some areas of silt exist, as those to the north of Simcoe. The eastern lands form part of the Haldimand clay plain, all of which was submerged in the waters of Lake Warren. While the till plain of the area previously discussed was covered by deltaic sands to some depth, the till plain of this region accumulated a veneer of heavier sediments. A fair proportion of the heavier soils south from Simcoe to the lake are probably the result of stream erosion stripping the sandy cover.

That part of the watershed east of Simcoe, while containing predominantly heavy soils, is by no means uniform. Although some of the sandy patches are displayed on the map there are a large number of others not shown because of their small size. Often these occur as low knolls or ridges. In many cases they may represent offshore bars developed in Lake Warren. There are, too, cases where the underlying till rises to the surface. Frequently the surface materials are silty. Impeded soil drainage is common. The topsoil tends to be acid and there seems to be a tendency toward the development of a hardpan.

Substantial truck crops are grown on the clay plains at Port Rowan. These tomatoes are intended for the cannery at Simcoe.

Tobacco is the major crop of the loamy and well drained sandy lands. The typical 2-year rotation of rye and tobacco is shown here.

The land use of these areas is similar in many respects to that prevalent on the moraines and the till plain. Dairying is common but cash cropping is of importance for canning and consumer sale. Tomatoes, peas, strawberries, cucumber, pumpkin and cabbage are among the crops to be found. Much of the produce is sent to Simcoe for processing.

The bulk of the area is drained by the Big Creek, Nanticoke Creek and the Lynn River. The former wanders in a shallow valley for some distance in its headwaters region but begins to incise near Teeterville and from there to near the lake occupies a fairly deep and narrow valley. The Lynn system is less well entrenched and the valley itself is more open. Along the lakefront there are a number of small streams, some of which have cut deep valleys. The creek which debouches at Fishers Glen, for example, has cut a valley of 100 feet or more in depth.

Reference to conditions of stream flow shows that after a very dry summer, only those streams originating in or flowing through the sand plain had a permanent flow. The Black Creek branch of Lynn River at the end of August, 1955, was dry or contained only standing pools. It lies almost completely in the clay plain. The Nanticoke Creek is similarly situated but the headwaters lie within the sand plain and there are, in addition, swampy areas and the spring-fed Waterford ponds which contribute a measure of flow. Further information on the matter may be gleaned from the map of stream flow found elsewhere in this report.

The present shore bluff has been cut by the waters of Lake Erie and recession is still taking place, usually to the detriment of lakefront landholders. Turkey Point and Long Point, of course, owe their existence to this erosion, the sediments being in part redeposited at these places. Such physiographic development is natural to most shorelines. The lake bluff is generally highest and steepest where the sand plain abuts on the lake. Immediately west of

Normandale, for instance, it is up to 150 feet or more high and correspondingly steep. In general the bluff is less prominent where the clay plain reaches the lake. East of Port Dover it becomes comparatively meagre and this is no doubt in part due to the bedrock which begins to outcrop at the lake in this area.

CHAPTER 2

SOIL AND WATER CONSERVATION

1. Introduction

A resources inventory survey for conservation purposes was made of the Big Creek valley in 1950 and reports on the findings were subsequently published.* Later, and at the behest of the Big Creek Region Conservation Authority, a soils, land use and water resources survey was made of the North Creek, one of the tributaries of the Big Creek.† Because of the water needs of the town of Delhi, which is served in part by this stream, and the increasing use of its waters for irrigation in the production of tobacco, a prime concern of the report was that of water resources.

Since the latter survey was made the Authority has been increased to about twice its original size with the inclusion of a considerable number of streams. A substantial portion of the lands involved possess heavier soils than are found over much of the former Big Creek Watershed. These lands are not suited to the production of bright leaf tobacco, as are the well-drained sandy lands of the Norfolk plain, and there is a much greater emphasis on dairying.

The general pattern of land use is thus somewhat different to that found over much of the sand plain and the problems involved, though similar in many ways, are also different. For this and other reasons it was thought desirable to provide the Authority with a detailed report on a selected area for its consideration and action. This area embraces a small valley, the Upper Black Creek, lying to the east of Simcoe. Most of this watershed lies within the region of

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* Big Creek Conservation Report, 1953. Conservation Branch, Ontario Department of Planning and Development.

† North Creek Conservation Report, 1954. Conservation Branch, Ontario Department of Planning and Development.

heavy soils but a part of it, the western portion in particular, also takes in some sandy land, much of which is imperfectly or poorly drained and unsuited to tobacco in its present state.

The methods used in making the survey were essentially those followed on the North Creek, to which report reference may be made.

2. Soil and Water Conservation

Conservation of our soil and water resources involves the use of every acre according to its capability and its management according to its need. It does not mean preserving these resources from use but does mean that they should be used wisely according to our present knowledge and needs. Not all land, therefore, is capable of the same use or the same intensity of use. In the Big Creek Region, and in the Upper Black Creek Watershed itself, many acres have been used too intensively in the past and the land has been eroded or exhausted of much of its fertility. Some of this land has been reclaimed to forest or some other use. By the same token, there is land capable of being used more intensively but which is now idle, in poor pasture, in scrub and weeds, or in poor forest.

Each type of land has a range of uses to which it is best suited and of this most farmers are quite cognizant in a general way. That is, they know full well that some crops do well on some lands and poorly on others and that some lands are suited to tractor work and others are not. A fuller understanding of the capability of land is to be gained only by examining it closely from a number of points of view. An examination of this kind was carried out with reference to the Upper Black Creek Watershed and the results are embodied in the map of Recommended Land Use which accompanies this report.

The land of the Upper Black Creek valley was mapped according to its capability to determine those areas

When clean cultivated garden crops like this are grown the land requires particular care to prevent erosion and maintain fertility.

The extensive, imperfectly drained, level clay lands suffer little from erosion but require drainage and fertility maintenance to produce good crops.

where a change in operation from that prevailing would be fruitful. On the basis of this inventory some recommendations have been made with respect to land management. Where a change in use or management is indicated it may often be carried out quickly and at minimum effort and expense. Frequently simply a change in method is all that is needed to align use and capability. The problem is not always so simple, however, and sometimes the desired change must take place over a longer term and perhaps at some expense and effort.

Where the changes required are reasonably simple they can be carried out in most cases by the farmer himself to his advantage. Those demanding the application of technical experience, a longer period of years to accomplish, or a greater outlay of funds than are at the disposal of the farmer might logically become partially or wholly the Authority's responsibility. At the same time the Authority should, as deemed desirable and possible, aid the farmer in bringing about the changes needed on his farm.

No program of valley improvement can succeed wholly, even in a small valley like that of the Upper Black Creek, unless the people of the watershed give it their full support. They must devote themselves as much to the maintenance and improvement of their valley community as they would to any community of which they are part. Every resident of the watershed has a stake in the land, water, wildlife, forest and recreation resources of the area and for his own benefit, if for no other reason, should see to it that these values are maintained or improved.

CHAPTER 3

PHYSICAL LAND CONDITIONS IN THE UPPER BLACK CREEK VALLEY

1. Introduction

The Black Creek is a major tributary of the Lynn River which it joins at Port Dover a short distance inland from Lake Erie. The section of the valley surveyed lies chiefly to the north of No. 6 Highway and embraces an area of approximately 15,450 acres, or 24.7 square miles. The village of Waterford and the town of Simcoe lie just off the watershed to the north-west and west. The watershed is very nearly rectangular in shape and about 7 miles long from north-west to south-east.

Topographically the region is quite uniform and over wide areas the change in elevation is slight. Along the Galt moraine in the west, however, the land does rise some 50 to 75 feet above the general level to attain an elevation of about 825 feet above sea level (a.s.l.).

The plain to the east of the moraine ranges between about 675 feet a.s.l. and 740 feet a.s.l. and is broken by the valleys of the Upper Black Creek and its tributaries. The valleys formed are not deep but are quite marked. Along their slopes erosion is often severe and numerous gullies may be found.

2. Physiography

The Upper Black Creek Watershed lies athwart the boundary separating the physiographic regions mapped by Putnam and Chapman as the Norfolk Sand Plain and the Haldimand Clay Plain.* The former is a glacial deltaic formation and covers most of Norfolk County and parts of the adjacent counties on the west. The Haldimand plain covers nearly all of the Niagara

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* Chapman, L.J. and Putnam, D.F. "The Physiography of Southern Ontario" University of Toronto Press, 1951.

Peninsula east of a line between Hamilton and Port Dover. The soils of the plain are heavy, relatively stonefree and over wide areas are imperfectly or poorly drained. Chiefly because of a difference in soils the two regions are dominated by different forms of land use. The Upper Black Creek valley is affected by both.

Except in a very general way it is impossible to draw a line separating these two regions. Close examination of the watershed reveals the fact that many islands and peninsulas of sand intrude into the clay plain. Usually these sandy deposits are small in size and occur as a thin veneer over the underlying clay. Soil drainage is often restricted.

The heavy soils themselves are somewhat variable and reflect the mode of deposition. The surface materials are chiefly lacustrine, the mark of glacial Lake Warren which covered the area, but the heavy tills are never too deeply covered and come to the surface here and there, particularly in the north. Sometimes silty deposits may be found but these are of small extent. Although the soils are by no means stony, bouldery deposits may be found on the plain in the northern reaches of the watershed. These were presumably deposited by the ice and many of them are granitic.

The soils also tend to be stonier along the edge of the Galt moraine. The stones are a product of Warren beach development. The moraine itself is quite sandy and much smoother than most moraines. It has been covered very largely by sandy outwash.

The limestone bedrock is of relative unimportance in this area although it does come to the surface in the east in stream beds. In several places the rock has been quarried in the past. The effect of the bedrock on land use is minor but it would, no doubt, have some importance in dam construction. The relation of the bedrock to water supplies was not examined. Most of the wells are fairly shallow and the water appears to be quite satisfactory for domestic use.

Profile of Berrien Sandy loam. The top of the heavier, underlying clay is just below the top of the shovel blade. The gray-coloured band of varying width is the A2 horizon.

Sometimes the limestone bedrock reaches the surface in the valleys of intermittent streams.

One other feature of the watershed might be mentioned. To the north of Renton is to be found a ridge of sand partly windblown and now largely reforested. This ridge is considered to be a sand dune formed at the time of Lake Warren. After being cleared of trees it became open to wind erosion and this has largely been corrected by returning it to trees. This is its best use.

3. Soil Conditions in the Watershed

As has already been mentioned there are two broad classes of soils in the watershed and this fact, combined with climatic and other conditions, has had considerable influence on the type of land use. There are, on the one hand, the sandy and rather gravel-free materials which have been used for tobacco and orchard crops, and on the other, heavy clays and tills which have been used chiefly for dairy and general farm production. In both cases land uses overlap to some extent.

(a) The Soil Profile

If the soil in a long-established woodlot or an old fenceline is examined closely, it will be found that it is composed of layers, or HORIZONS. Each horizon has distinct characteristics of colour, texture, structure, organic content, acidity and clay content which serve to separate it from the others in the PROFILE, as the vertical section through the soil from the surface to the parent material is called. Each soil has a characteristic profile and it is possible to classify and map soils as to groups and types.

Most well drained soils in Southern Ontario belong to a great group of soils known as the Gray-Brown Podzolics and they possess three distinct horizons designated as the A (the topsoil), the B (the subsoil), and the C (the parent material). The poorly drained mineral soils belong to the group known as the Dark Gray Gleizolics and these have a glei horizon in place of the B horizon.* There are also the organic soils, the peats

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* Glei is bluish-gray to olive in colour and rather sticky and compact.

and mucks. All these groups are represented in the Upper Black Creek Watershed.

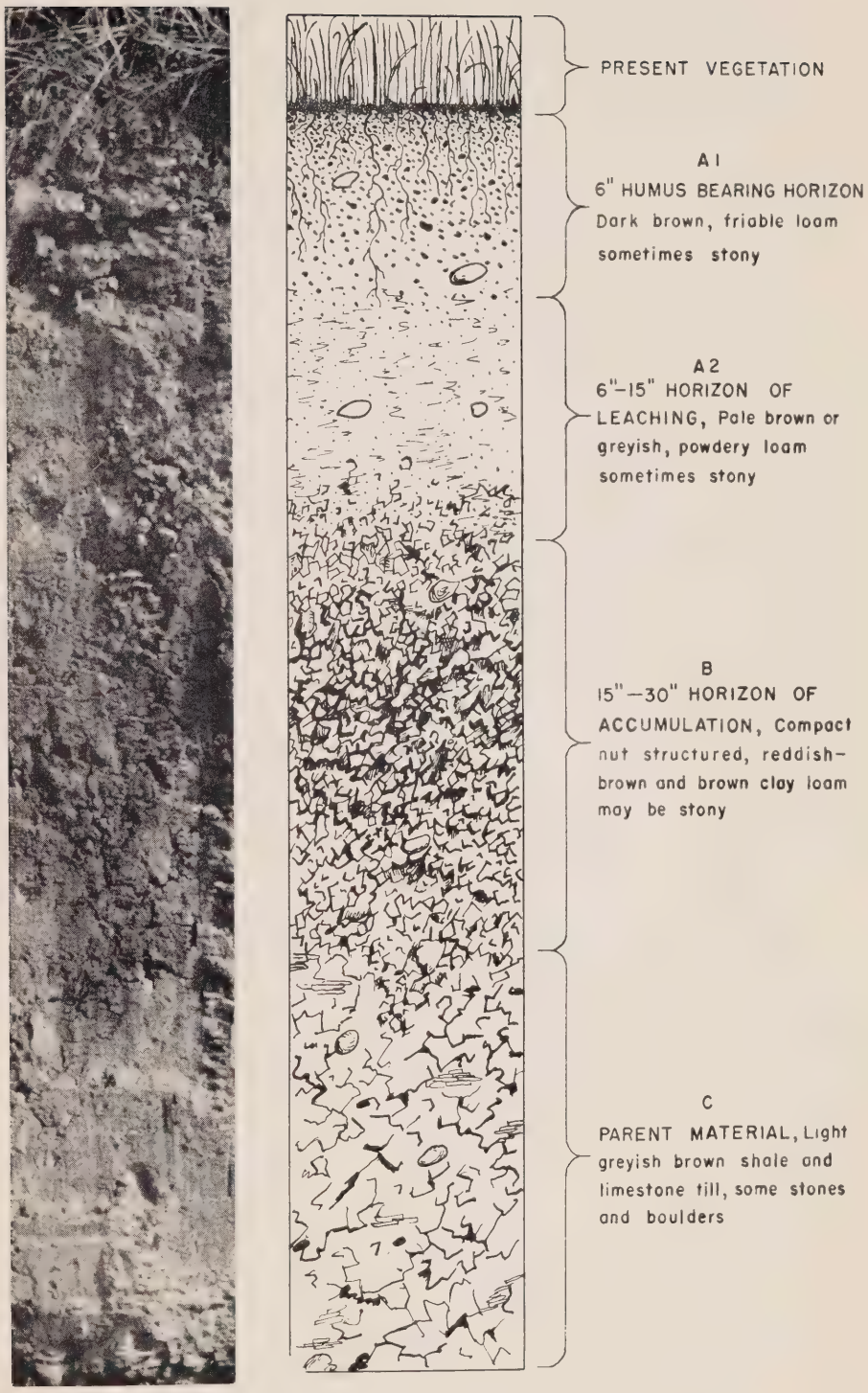
A group of soils developed on similar parent materials in the same region but differing in profile development because of surface relief or drainage is called a CATENA. Within a catena there may thus occur well drained, imperfectly drained and poorly drained members. Each member is designated as a SERIES and the catena usually takes its name from the well drained member. The series is broken down into TYPES based chiefly on the texture of the surface soil. Thus, in the Upper Black Creek valley there is the Fox catena with the Fox, Brady and Granby series representing the well, imperfectly and poorly drained members. The first two are Gray-Brown Podzolic soils while the latter belongs to the Dark Gray Gleizolic Group.

The following profile description, taken from the North Creek Conservation Report, is typical of a well drained soil in Southern Ontario.

Horizon

A_0	-	Decayed vegetation
A_1	-	Dark brown or gray material - loose, friable, containing humus and mineral material. Slightly acid in reaction.
A_2	-	The leached horizon has no humus. The iron, lime, organic matter and clay have been washed out. Light gray to yellow in colour and dusty in texture. Acid in reaction.
B	-	This is the zone of deposition in which the materials washed or leached from the A_2 accumulate. May be acid to slightly alkaline in reaction. Brown colour and blocky or nut-like structure. Free lime carbonates are found at the bottom of the B horizon
C	-	This is the unweathered parent material. The colour is grayish, and there is no structure as in the B. Free lime carbonates are found.

The A_1 horizon of a soil with restricted drainage is normally thicker than in the well drained soil although the profile itself may be shallower. Also, the A_2 horizon may be less well developed. Soils suffering restricted internal drainage are marked by rust-coloured streaks and blotches in the lower



Profile of a representative gray-brown podzolic soil.

horizons. Where poor drainage prevails the subsoil may be blue-gray to olive in colour, in contrast to the rich browns of the well drained soils.

(b) The Watershed Soils

Not all soils have the same capability, even though they may be topographically similar and superficially appear the same. The designation of land according to its capability and recommendations as to its use and management demand that the various soils be mapped as to type. The present state of erosion, susceptibility of the soil to erosion and surface slope are among the factors which must be considered.

For ordinary farm crops the sandy soils of the watershed range from fair to poor in adaptability but for some crops, such as tobacco and orchard crops, the well drained sands are quite suitable. Tobacco production is restricted to this kind of soil.

The well drained sands belong almost entirely to the Fox catena but a small acreage of Bookton and Plainfield is to be found. The first mentioned soil exhibits a well developed profile with a good structural B horizon. The soil is acid in reaction and deficient in potassium and phosphate but it responds well to adequate additions of commercial fertilizer. The imperfectly and poorly drained associates of the Fox are devoted to pasture and woodlot. The acreage of both series is limited.

The Plainfield sand is very restricted in area and almost entirely forested. Under previous management this soil suffered from wind erosion and drifted badly. It is now in its best use. The soil suffers excessive internal drainage and the B horizon is either lacking or chromatic only.

The Bookton catena is represented almost entirely by the Berrien and Wauseon series and the distribution of both is fairly widespread. Large areas of the poorly drained Wauseon are found adjacent to the moraine and the land is chiefly in woodlot. The imperfectly drained Berrien may produce comparatively good crops, particularly in a dry year and if adequately

fertilized. These soils are formed in a well sorted outwash which is found as a veneer of a few inches to two or three feet over clay till. Some of the underlying clay is lacustrine.

The Berrien sandy loam in particular is often found in widely scattered patches of small size. The effect on land use is negligible and the pockets and knolls are cultivated and cropped like the rest of the field. Although imperfect drainage prevails the profile of this soil is quite well developed.

The heavy soils of the watershed have developed in the veneer of lacustrine materials over the heavy tills. In places where the tills come to the surface, somewhat different soils have developed. Throughout the region, however, imperfect or poor drainage is a persistent factor influencing land use and affecting yields and crop quality. Except for the river valleys the land is almost everywhere level or very gently rolling and sheet wash has not been important. Depletion of the the organic content of the soil has sometimes been more serious.

A major soil of the plain, in terms of area, is the imperfectly drained Haldimand clay loam, a stiff clay soil that bakes to a hard mass in a dry summer. This is accentuated where the soil organic content has been reduced. In some places there appears to be a tendency for the development of an indurated B horizon, presumably the outcome of restricted drainage and a very slow natural erosion process. The combination of a stiff soil and restricted drainage at times results in poor crop growth, particularly during a dry summer. In part this is because the plants produce a shallow root system in spring because of a high water table and later are unable to send roots deeply enough as the water table drops. We thus have a crop suffering from drought in an imperfectly drained soil. This situation is by no means uncommon and adequate soil drainage is usually a cure for it. Perhaps chiefly as a result of the level terrain and the very slow rate of natural erosion this soil is particularly deficient in lime and phosphorous.

This heavy land is used primarily for the production of animals and animal products. Some beef cattle are maintained within the watershed but the emphasis by far is on dairy production. The production of hay, pasture, corn and feed grain is therefore favoured. Nevertheless, some of the heavy land is devoted also to orchard crops, principally apples and market crops for canning and fresh sale.

(c) Soil Erosion

The general question of soil erosion has been amply covered in the aforementioned North Creek Conservation Report (1954) but one or two remarks may be made concerning the present watershed.

Roughly 80 per cent of the lands drained by the Upper Black Creek have been affected to a minor degree only by wind and water erosion. This is so chiefly because so much of the land is nearly level to gently sloping. Where the land is more steeply sloping, as along the streams, erosion has been more severe. Particularly is this true where these slopes are cultivated or grazed in excess of their capacity.

Gullies have developed in numerous places along the various stream banks. Fortunately most of them are as yet small and action should be taken to control them before they increase in size. In heavy soils such as those found in this area gullies, once started, can become a serious problem and difficult to control if let get out of hand. At a number of points there is an urgent need for waterway control and this can be achieved best by grassing permanently the channels in question. Gullies are only part of the story, however, for most of the erosion has resulted from sheet wash on the gentle and steep slopes and on the knolls. Some of these lands can only suffer further deterioration unless adequately cared for. Where the measure is indicated the land should be removed from agricultural use entirely and reforested. In other cases a permanent grass cover and controlled grazing will solve the problem. On yet other land infrequent cultivation to grain and an emphasis on grass will do the job.

Sheet wash and gully erosion may result from overgrazing on the more steeply sloping valley lands. The light coloured patches indicate sparse vegetation and erosion into parent material.

Sheet wash and rill erosion can be quite destructive on moderately sloping land like this. The crop is oats.

The removal of the topsoil often leads to poor crop response. The corn is thinnest and weakest where erosion is worst.

"In fields where sheet erosion is prevalent it is not uncommon to find the crop on the upper slopes maturing before that farther down. Not only does the crop mature earlier but the stand is thin and short. Where the eroded material has accumulated, many crops, especially oats, will lodge and not mature properly.

"The Experimental Farm at Ottawa has reported the effect of decreasing the depth of topsoil on the yield of barley and alfalfa. The table that follows shows that barley is more susceptible to thin soil conditions than alfalfa, yet in both cases the yields on subsoils were not encouraging. The difference in the root systems may account for the marked reduction in yield of barley as compared with the alfalfa."*

THE EFFECT OF SOIL EROSION ON CROP PRODUCTION
(Central Experimental Farm, Ottawa)

	Barley (7 yr. av.) Bushels per acre		Alfalfa (3 yr. av.) Tons per acre	
	Fert.	Not Fert.	Fert.	Not Fert.
3" Surface soil added	46.8	33.3	3.24	3.04
Normal undisturbed soil	45.6	33.2	3.07	2.79
3" Surface soil removed	37.1	26.6	2.76	2.39
All but 1" surface soil removed	24.1	14.8	2.58	1.94
All of surface soil removed	11.7	4.0	1.73	1.44

The following table outlines the sheet erosion situation on the watershed as found during the survey. Some of the existing gullies have been indicated on the map showing recommended use. The Authority might consider the feasibility of assisting in the rehabilitation of some or all of the existing gullies.

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* "Ontario Soils - Their use, management and improvement". Bul. 492, September 1952. Ontario Department of Agriculture.

TABLE I

SHEET EROSION CONDITIONS ON THE
UPPER BLACK CREEK WATERSHED

Degree of Erosion	Acreage	Per Cent	
0	1,199	7.6	
1	11,423	73.8	
2	1,457	9.3	
3	342	2.1	
4	132	.9	
5	180	1.1	94.8
Bottomland *	759	4.8	
Muck *	56	.4	5.2
Totals	15,450		100.0

Degrees of Sheet Erosion

0 - No significant erosion.

1 - Less than 1/3 topsoil removed.

2 - 1/3-2/3 topsoil removed.

3 - 2/3 topsoil and less than 1/3 subsoil removed.

4 - All topsoil and less than 2/3 subsoil removed.

5 - All topsoil and more than 2/3 subsoil removed. Erosion usually into parent material.

* Erosion on bottomland and muck was not determined and is generally absent or negligible. These areas often accumulate materials rather than lose them.

CHAPTER 4

PRESENT LAND USE

The watershed is practically devoid of any industrial or urban development and except under very special circumstances the area is likely to remain almost completely agricultural for a long time to come. The lack of any resources apart from those of the soil, an inadequate water supply, and the general location would seem to preclude any such development. The future prospects of the region should therefore be considered primarily in terms of agriculture and steps should be taken now to preserve and improve the base on which this type of economy will rest.

The bulk of the land in the watershed is devoted to the production of feed crops. More than one third of the total acreage produces hay or pasture, either improved or unimproved, and almost one third is used to grow feed grains and corn. Of the remaining land a considerable proportion is devoted to the production of a number of horticultural crops, while a considerable acreage is covered by forest. Some fine woodlots do exist but most of the woodland is of indifferent quality.

The economy of the area depends primarily on the production and sale of animals and animal products. Dairy production is highly important and a field check of the cattle population revealed that dairy breeds were favoured over beef breeds in the ratio of 14 to 1. Beef production is not an important enterprise. No data were gathered concerning other farm livestock. It should be noted, however, that several farmers have entered the poultry and turkey business on a commercial scale. There is prospect of further development in these lines as our population expands. In addition, there is one mink and fox ranch on the watershed, but this can be considered as a form of agriculture only in a loose sort of way.

A small acreage is devoted to the production of high-income-cost special crops. In some cases the production of these crops forms the whole of the farm enterprise and in others is a lucrative but secondary source of income. Tobacco, orchard crops (chiefly apples) and some truck crops are full-time endeavours for a number of growers. The market crops are varied and include such things as cucumbers, potatoes, strawberries, gladioli, cabbages, pumpkins, peas, grapes, peppers, tomatoes and cauliflowers. Table and seed corn are also grown. The bulk of the vegetable production goes to Simcoe or Waterford for processing but some finds its way into the fresh market.

Most of these special crops are grown on the western side of the watershed on the better drained sandy lands or on the fringe of these lands. In the case of tobacco, location on these soils is mandatory. The other crops are not so selective in their requirements and the soils used vary from the sandier types to those where the clay fraction is fairly high. Imperfect soil drainage seems to be a relatively minor hindrance in the production of these crops although wet years would cause trouble where artificial drainage works do not exist.

The balance of the productive land in the watershed is in forest. Most of it is best suited to this use and should so remain. In the majority of cases, however, the present stands could be improved considerably through thinning, removing of diseased trees, selective cutting, and a restriction on pasturing. Although some land has been reforested, a moderate acreage still exists where, because of steep slopes and severe erosion, this treatment would be desirable. There is, in addition, some scrub land on the watershed which is incapable of being used as forest and which provides only the roughest and uneconomic form of pasture. Land like this should either be treated to provide better pasture or fenced and managed to produce productive woodland.

Apples are locally important and production is likely to expand.

Pea Viners — another reflection of crop diversity.

Farm ponds are important in water conservation. They should be properly built and maintained and those used for stock-watering should be fenced and provided with an outside trough.

There are approximately 270 separate land holdings on the watershed where agriculture is the basic use. Of these 270 holdings, about 57 per cent are smaller than 50 acres in size and nearly 28 per cent are less than 25 acres in size. Fragmentation like this is typical of areas where horticulture and special crop production is important. It should be noted, however, that many of the holdings of close to 50 acres are devoted to general farming.

The majority of holdings over 50 acres embrace about 100 acres of land and almost without exception these are devoted to dairying and general farming. There are only a few farms larger than this and none exceed 200 acres in size.

There are few farm ponds in the area, although it would seem they could be used to good advantage for stock watering and irrigation. The value of irrigation is appreciated by most of the tobacco, tree crop and vegetable growers, and there has already been some disquieting competition for stream water supplies. These supplies are severely limited, however, particularly in dry years, and over-use would have a detrimental effect on stream flow. A partial solution to the problem may be found in the farm pond. Of these, the dug-out, run-off and permanent stream types would appear to have most application. The regulation of permanent streams by dams by riparian owners is not a matter which may be left completely to the discretion of these owners. Under the Statutes of the Province of Ontario it is unlawful to dam a permanent stream without first securing permission from the Surveyor-General, which means that a plan must be filed in his office. Unlawful interference in the flow of permanent streams by the use of structures is a matter warranting supervision by the Authority.

The following table summarizes the land uses found during the survey.

TABLE 2

PRESENT LAND USE

Use		Acres		Per Cent
Hay			2,465	15.9
Pasture			3,046	19.7
Grain			3,182	20.6
	Oats	1,556		
	Wheat	1,109		
	Mixed	259		
	Rye	178		
	Buckwheat	80		
Corn			1,971	12.8
Horticultural Crops *			1,401	9.1
Forest			2,070	13.4
	Not pastured	883		
	Pastured	921		
	Scrub	120		
	Plantation	146		
Orchards			377	2.4
Idle			569	3.7
Buildings and Urban			354	2.3
Miscellaneous †			15	.1
Total			15,450	100.0

* Includes such crops as grapes, tomatoes, peas, cucumber, strawberries, peppers, cabbages and potatoes.

† Includes water bodies, quarries, etc.

CHAPTER 5

LAND CAPABILITY AND RECOMMENDED LAND USE

1. Land Capability

Before the land of a watershed can be planned for the purposes of soil and water conservation, it must first be surveyed to determine its use capability and then classified accordingly. The system of classification used is similar to that used by the Department of Soils, Ontario Agricultural College, in the planning of farms.

In classifying the lands of the watershed, several questions were kept in mind: (a) Was the land suited to the type of agriculture prevailing and if so, could it be tilled without the risk of erosion? (b) If erosion was a restricting factor, how great a risk was entailed in devoting the land to continual cultivation? (c) Was the safe use of the land limited to the production of permanent vegetation and if so, should the cover be grass or forest? (d) What was the position respecting soil drainage? (e) To achieve minimum risk should the land be cultivated only part of the time? There were also other questions which entered into the construction of the map of recommended use which accompanies this report.

In assessing the suitability of a piece of land for agricultural use, the piece of land in question is rated according to one of the four following categories:

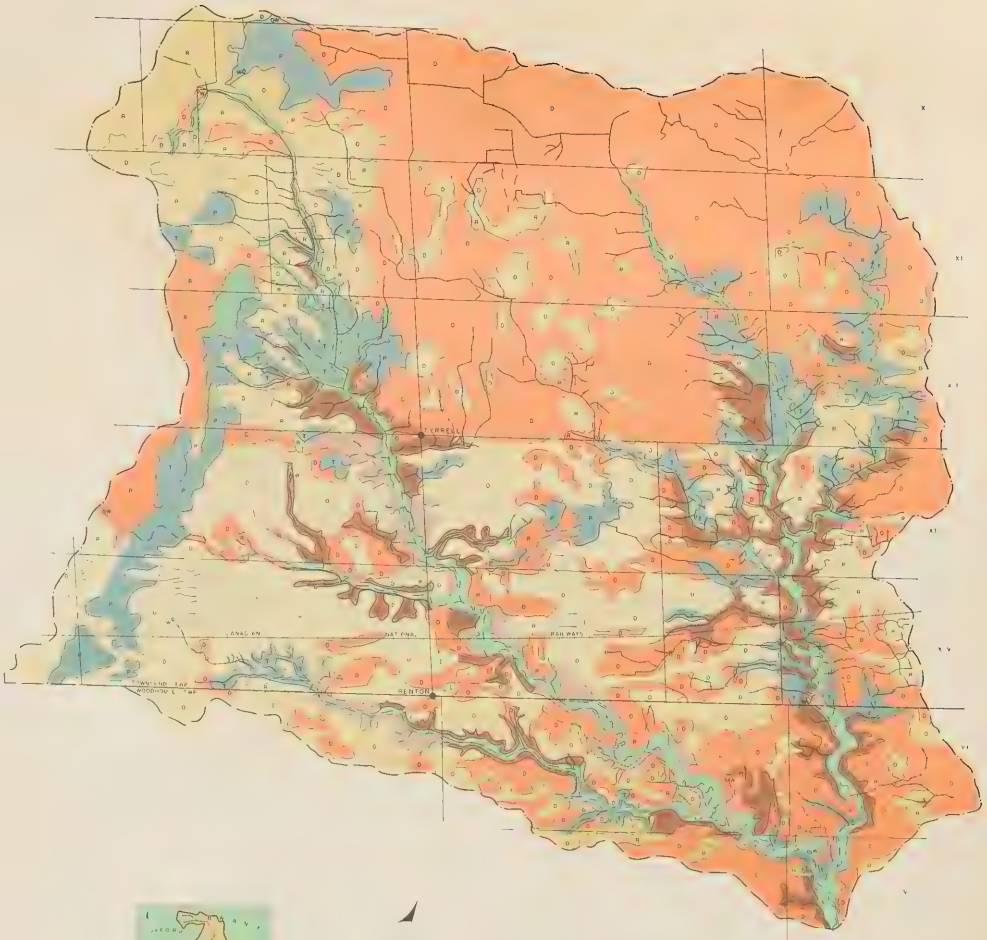
A - Suitable for cultivation

B - Suitable for only occasional cultivation

C - Suitable only for permanent vegetation and unsuitable for cultivation

D - Not suitable for cultivation or for commercial grazing or forestry.

Within these broad categories various classes of land are recognized.



BIG CREEK REGION WATERSHED

UPPER BLACK CREEK VALLEY

RECOMMENDED LAND USE
ACCORDING TO USE CAPABILITY

USE CAPABILITY CLASSES

SUITABLE FOR CULTIVATION

(No class I land mapped)

II — WITH SIMPLE PRACTICES

III — WITH INTENSIVE PRACTICES

SUITABLE FOR LIMITED CULTIVATION

IV — WITH SOME SPECIAL PRACTICES

SUITABLE ONLY FOR PERMANENT VEGETATION

V — WITH SOME SPECIAL PRACTICES

VI — WITH MODERATE RESTRICTIONS

VII — WITH SEVERE RESTRICTIONS

RECOMMENDED MANAGEMENT

C — LAND REQUIRING EROSION CONTROL BY CONTOUR TILLAGE METHODS

D — LAND REQUIRING ARTIFICIAL DRAINAGE

R — LAND REQUIRING RESTRICTIONS IN USE

(These apply to classes IV, V, VI, VII)

T — RESTRICTED USE DUE TO ROUGH TOPOGRAPHY

F — RESTRICTED USE DUE TO INADEQUATE DRAINAGE

(These apply only to class IV)

LAND UNDER EXISTING FOREST COVER

WATERCOURSE

GULLIES

DITCHES

INTERMITTENT FLOW STREAMS

PERMANENT FLOW STREAMS

PONDS

SCALE 0 500 1000 2000 3000 4000 FEET

terraces, strip-cropping or buffer strips. Some land susceptible to erosion but capable of being farmed using these methods is also placed in this class.

Land whose surface varies from level to sloping but which is unsuited to contour tillage, although subject to erosion, drought or fertility depletion, may be placed in class R. Hummocky land is usually placed in this category. Vegetative methods of control such as rotations, winter cover crops and soil-building crops are indicated.

Wet land whose productivity can be improved through artificial drainage with minimum difficulty and expense is indicated by the letter D. Class III D requires more intensive application than class II D.

Class IV land may be land too rough or eroded to be put under regular rotation and is indicated as IV T. Land which is too wet for regular rotations and on which artificial drainage is not feasible because of lack of outlet or the expense involved in providing one is classed as IV P. Normally suited only to pasture or forest, land of this class may, however, be cultivated and cropped in a dry year. Class IV P land differs from class V land in that it is not subject to periodic stream inundation.

Land Class I

Because of restrictions of one kind or another, including restricted drainage, depletion of soil fertility and structure, and erosion, no class I land was mapped in the watershed.

Land Class II C

As may be seen from table 3 only a small acreage has been designated as class II C land. The slopes of this type range from 2 to 6 per cent, are smooth, and are suited to contour cultivation methods. Strip cropping, diversion terraces and grassed waterways find application on this land.

Land Class II R

This land class includes hummocky land with slopes ranging from 2 to 7 per cent and smoothly sloping land which is broken by watercourses to the extent that contour cultivation would be impractical. The acreage of this land is considerable and amounts to over 9 per cent of the watershed.

Erosion is mild to moderate and may be controlled by good rotations, the use of winter cover crops and the restriction of intertilled crops on the more steeply sloping land.

Land Class II D

Nearly 1/4 of the watershed has been designated as class II D. The chief hazard to crop production on this level to gently sloping and nearly erosion-free land is that of restricted drainage. Outlets are available and artificial drainage of this land may be achieved fairly easily. Some of the land has already been so treated. Adequate drainage helps to reduce frost heaving of the crops, prevents crop drowning, and enables the farmer to enter on the land earlier in spring.

Land Class III C

A very minor acreage - less than 1 per cent of the whole - has been classed as III C. The slopes of this type are smooth and range from 6 to 10 per cent. In some cases gently sloping but more severely eroded land has been included.

Land Class III R

Nearly 4 per cent of the watershed area has been classed as III R land. Like the II R the nature of the land is such that contour methods of cultivation are impractical. As with land classes IV T, VI and VII, most of the type is found along the stream valleys where dissection has resulted in rougher topography.

The slopes are somewhat steeper than on II R land and erosion is often more of a problem. In some cases less rugged land which has been more severely eroded has been placed in this class. Also, some phases of what normally would be considered class III land have been placed in class IV because of severe erosion.

Intensive restrictions in use are required to prevent more serious erosion and fertility depletion on this land. The use of longer rotations and the growing of soil-building grasses and legumes are indicated.

Land Class III D

This land class is associated almost entirely with the heavy soils of the watershed. The land is level to gently sloping and erosion is not a problem even under fairly intensive use.

The restricted soil drainage is more severe than in class II D and may be overcome by the installation of ditches or tile underdrainage. A considerable amount of both already exist. When adequately drained and properly managed these soils are quite productive. In the southern portion of the watershed particularly these soils tend to be deficient in organic material and low in phosphates. Applications of lime may often be beneficial in correcting acid soil conditions where these exist.

Land Class IV T

Land of this class is located chiefly along the streams and should be restricted from regular cultivation because of rough topography and susceptibility of the soil to erosion. In numerous places erosion is already quite severe. The land is not generally good for tractor work.

The class involves about 5 per cent of the watershed and is best placed under a permanent grass cover with controlled grazing. Cultivation for pasture renewal may be done occasionally with reasonable safety. The occasional grain crop may also be grown.

Land Class IV P

The acreage defined as class IV P is confined to those wet areas which cannot be drained economically Erosion is negligible and in a dry year, with a lower water table, a satisfactory crop may be taken off. Where the land has not been cleared the forest should be left and improved.

Land Class V

This type includes those areas subject to periodic flooding, chiefly the flat lands of the valleys adjacent to the streams. It includes the small muck areas found within the watershed. By and large the land is clear and devoted to permanent unimproved pasture. In some places a tree cover prevails and should so remain. The benefits to be gained by clearing would be offset by the cost of so doing.

The chief hazard to use is that of poor drainage combined with periodic flooding. In addition the land is cut up by the streams to the extent that cultivation is difficult or impossible. Normally the land requires no special conservation practices apart from woodlot protection and pasture management. Also, more consideration should be given to stream and stream-bank protection. It should be noted that the class, as outlined on the map of recommended use, may contain small areas of what would normally be considered as class VI or class VII land. The scale of mapping has demanded that these areas be included as class V.

Land Classes VI and VII

Taken together these lands make up over 7 per cent of the watershed. Both types are found along the valley slopes and the land is rough and steeply sloping. Severe sheet erosion and gully wash is often a problem.

The distinction between the two classes is one of degree rather than kind, the designation VII meaning that control of use should be more severe than on class VI land.

Because of the erosion hazard and difficulty of working neither class should be regularly cultivated. If left

in pasture grazing should be restricted. In many cases, where woodlots are not already present, reforestation would be the best practice.

Land Class VIII

There is no class VIII land in the watershed.

TABLE 3

RECOMMENDED LAND USE

Land Class	Acres	Per Cent
I	None mapped	None mapped
II C	220	1.4
II R	1,443	9.3
II D	3,804	24.5
III C	118	.8
III R	444	2.9
III D	5,932	38.5
IV T	812	5.3
IV P	586	3.8
V	921	6.0
VI	797	5.2
VII	363	2.3
	15,450	100.0

CHAPTER 6

FARM PLANNING

To most farmers the idea of planning is not something new; in some measure or other they plan the use and management of their land so that they know a year or so in advance what cultivation sequence they are going to follow. They plan for repairs to buildings, equipment, fences and so on. They plan so far as they can the day to day and month to month work they are going to do, and much of it becomes routine. Planning, in short, is an essential feature in the life of the farmer as it is with anyone concerned about his future.

Although many farmers have a plan regarding the use to which they put certain or all of their fields, relatively few have had their farms planned so that the maximum use, consistent with the best use, is made of each piece of land. The object of a plan of this sort is to enable the farmer to get the most out of his land and at the same time to do it in such a manner that no damage to the land occurs. When a farm is planned each piece of land is judged according to its capability to produce, and various use recommendations are made. These may include pasture management, crop rotations to follow, woodlot management and reforestation, farm drainage, fenceline removal or relocation, or any other works and practices which would benefit the farmer and his land.

Planning does NOT need to be so rigid that there is only ONE recommended use or management for a piece of land of one class. Alternative recommendations may be made for a piece of land in a certain class. The first rule is to apply the easiest and cheapest remedy. The next thing that determines the choice of use is the relation of the field to the rest of the farm. Other factors apply, such as suitability for using powered mechanized equipment, or the distance from the barn and ease of access. The final determination depends on the crops and animals the farmer chooses to carry. The final plan, therefore, is the end result of a good many compromises and at each stage of preparing the plan certain choices have to be made.

In this section an actual farm plan, prepared by the Soil Advisory Service of the Soils Department of the Ontario Agricultural College is presented. The soils are typical of those found over much of the watershed.

In developing the plan a farm planner goes over the farm field by field and maps the soils as he finds them. He uses an aerial photograph as a base map. The soil series and types are identified and an estimation of the degree of erosion is made by examining vertical sections of the soil. The slope of the land is measured, using a hand level which gives slope as a percentage. A rise of four feet in a run of one hundred feet, for example, is a 4 per cent slope.

The occurrence of watercourses, either permanent or intermittent, with or without a definite channel, is noted, as are fencelines, stonepiles, springs, seepage areas, gullies or any other items of importance.

All of the information gathered is marked on the map, using symbols, and each piece of land of the same type with respect to soil, slope and erosion is delimited by a boundary line.

From the map of soil type and conditions a map of use capability is prepared. Each piece of land is assigned to one of eight capability classes. These classes are the same as those used for the watershed and are included here as part of the plan. On any one farm not all classes will necessarily be found.

The plan of the farm is then worked out with the farmer so that each field, or each piece of land, is put as nearly as is practicable to the use which fits the capability. Any systems of tillage or cropping or special practices to control erosion and water loss are applied where necessary. The fields and rotations are worked out so that there is the correct balance of pasture, fodder and grain to meet the requirements of the herd which the land can carry.

Before the planned rotations are put into effect it may be necessary to arrange a transition period in which the change-over from present cropping to the planned rotation is made without losing a year of cropping. Also, it may take a year or two to get special devices like grassed waterways and terraces in working shape. A time of transition such as this may also prove useful in providing a period during which any desired changes in the plan may be implemented.

In adjusting use to capability it may not be possible to outline fields exactly according to natural soil conditions. The inclusion of a small area of, for example, Class II land in a field which is predominantly Class I land may mean that this small area of land of lower capability will be worked as intensively as the Class I land. This is not strictly following the principle of "using each acre according to its ability", but is a compromise weighed against the possible cost of fence removal, difficulties of tillage and so on. In a plan, therefore, there may be found one or more small areas of one land class within a larger area of another land class.

The recommendations made by the planners are sensible and as often as not can be implemented at little or no cost. Sometimes a more substantial outlay is required to bring the use of the land, and the manner of its use, in line with its capability. The success of the venture, of course, depends very largely on the enthusiasm of the individual farmer and each step taken should be integrated into the farm business.

FARM PLAN

for

D. A. SCHOOLEY

R. R. 1, Windham Centre
Ontario

County - - Norfolk

Township - - Townsend

Concession - X

Lot - - - 4

Part of Lot - South half

Prepared by

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In co-operation with Mr. D.A.Schooley

SOIL, SLOPE AND EROSION

MAPPING SYMBOLS USED IN FARM PLANNING

MAPPING SYMBOL (EXAMPLE)

582 sl ← Soil Type
3B1 ← Degree of Erosion
Slope Group
Per cent Slope

SOIL TYPES ON YOUR FARM

582 s - Fox sand
582 sl - Fox sandy loam
584 sl - Brady sandy loam
586 sl - Granby sandy loam
284 l - London loam

SLOPE GROUPS

UNIFORM SLOPES

A – 0 - 2 *per cent*
B – 2 - 6 " "
C – 6 - 10 " "
D – 10 - 15 " "
E – 15 - 20 *per cent*
F – 20 - 30 " "
G – 30+ " "

IRREGULAR (HUMMOCKY) SLOPES

M – 0 - 7 *per cent*
N – 7 - 15 " "
P – 15 - 25 " "
R – 25+ " "

DEGREE OF EROSION

WIND AND WATER EROSION

0 – No noticeable erosion
1 – Up to ½ of the "A" horizon removed by erosion.
2 – Same "B" horizon material in the cultivated layer.
3 – Some "C" horizon material in the cultivated layer.
4 – Gullies too deep and too frequent for the land to be cultivated.
+ – Accumulation of eroded materials.

INDIVIDUAL GULLIES

Shallow
Into subsoil
Into parent material

STONINESS

0 – No stone
1 – A few stones but not sufficient to interfere with cultivation.
2 – Sufficient stone to be a nuisance to cultivation but land can be used for regular rotation.
3 – Too much stone for cultivation but land suitable for pasture.
4 – Too much stone to be used for pasture but suitable for trees.

WATERCOURSES

Permanent streams
Intermittent streams
Spring
Sod waterway
Proposed tile

SOILS DEPARTMENT, ONTARIO AGRICULTURAL COLLEGE, GUELPH, ONTARIO.

OBJECTIVES FOR FARM PLAN

The following plan for the use of the land on your farm is designed to:

(a) be a practical working unit.

(b) use the land according to its capability without serious deterioration.

(c) maintain the soil at an economically high level of productivity.

(d) produce an approximately equal acreage of each crop each year.

(e) minimize soil and water losses

In preparing the plan the following procedure is followed. First, the soil, slope and erosion are mapped on an aerial photograph. Second, the capability for agricultural use is then worked out on the basis of type of soil, stoniness, drainage, steepness of slope and the tendency of the soil to erode. Third, in co-operation with the farmer the farm layout and crop rotations are worked out on the basis of the land-use-capability units (described in the following pages).

Suggested cultural, management and fertility practices are outlined. The location and acreage of any crop in any year is readily found by referring to the cropping schedule.

Discussions on cropland, permanent pastures and woodlots should be supplemented by material found in various bulletins dealing with the different subjects. The material found in such publications is based on years of experience and experimental work and should be adapted to your farm in so far as is practical and applicable.

LANDS WHICH MAY BE CULTIVATED

Class 1 (Green)

Class I land is suitable for cultivation without special conservation measures. It must be nearly level, workable,

LAND USE CAPABILITY

I	II	III	IV
			None

V	VI	VII	VIII
	None	None	None

productive, well-drained and not subject to erosion or over - flow. This land requires the addition of plant foods that are used by crops or lost by leaching. These plant foods are returned by barnyard manure, green manure crops or commercial fertilizers. Crop rotations to assist in maintaining the productivity are recommended.

Class II (Yellow)

Class II land is suitable for permanent cultivation with some simple practices often required. Chief types of practices are erosion control, water conservation, correction of moderately low fertility and the removal of boulders. The practices to conserve soil and water include contour cultivation and strip cropping with crop rotations that include legumes and grasses. The various sets or combination of practices must always be practical and useful in maintaining soil productivity.

Class III (Red)

Class III land is suitable for permanent cultivation with intensive conservation measures. This land requires careful and intensive application of practices to conserve soil and water. The type of practices are similar to those applied on Class II land but their use must be more intensive and widespread. Class III land requires longer rotations of legumes and grasses, cropping in narrower strips, buffer strips grassed waterways, diversion ditches and greater use of cover crops. Class III land is generally characterized by one or more of the following features: steeper slopes, greater degree of erosion, lower fertility or handicapped by stones, boulders and poor drainage. This land requires additional treatments to maintain the soil at adequate fertility levels for the production of moderate to high yields of good quality crops.

Class IV (Blue) *

Class IV land is suitable for occasional or limited cultivation. This land is generally handicapped by one or more of the following: steeper, more severely eroded, more susceptible to erosion, more difficult to drain, less fertile, droughty or restricted in use by stones, boulders, or scrub tree growth. The types of conservation measures applied to this class aim at removing, in so far as possible, the limiting features. To reduce soil losses and conserve rainfall on the steeper slopes, five- to six-year rotations consisting of one year grain and the rest in clovers and grasses are frequently used. Class IV land may be set aside as a pastured area to be broken up and reseeded every fifth or sixth year.

LANDS WHICH SHOULD BE KEPT IN GRASS OR TREES

Class V (Dark Green)*

Class V land is not suitable for cultivation but is suitable for a permanent vegetation that may be used for grazing or woodland. This land is not subject to erosion but is generally too wet or stony for cultivation.

Class VI (Orange)*

Class VI land is suitable for permanent vegetation that may be used for restricted grazing or woodlot. Most of the land is moderately eroded or steep droughty soils of low fertility. When used for grazing such restrictions as carrying capacity, deferred grazing and rotation of grazing must be practised.

Class VII (Brown)*

Class VII land is not suitable for cultivation and requires severe restrictions if used for grazing. Pastures generally require liberal applications of fertilizers and

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* These classes are not found on the farm described here.

careful regulation of the grazing. A large part of this land should be reforested or kept in woodlot and fenced from livestock. Most of the land in Class VII is steep, rough, eroded and highly susceptible to erosion.

Class VIII (Purple)*

Class VIII land is not suitable for cultivation or the production of permanent vegetation. The land is chiefly rough, extremely stony barren land or swamps and marshes that are permanently wet and cannot be drained.

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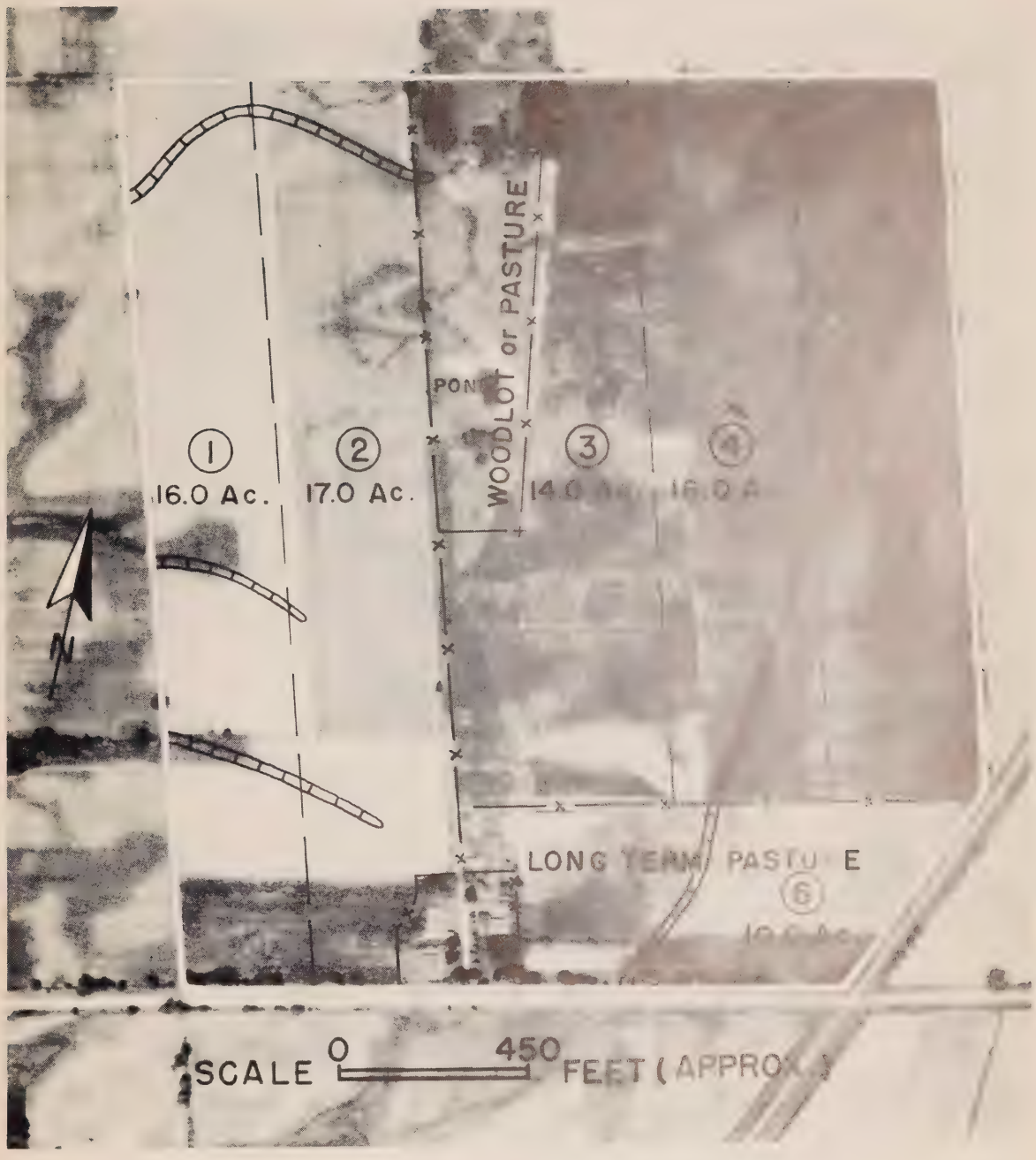
* These classes are not found on the farm described here.

FARM PLAN


WOODLOT or PASTURE
POND
1
16.0 Ac.
2
17.0 Ac.
3
4
LONG TERM PASTURE
6
N
SCALE 0 450 FEET (APPROX.)

CROPPING PLAN

Field No.	Acreage	1	2	3	4	5	6
1	16.0	Corn	Pot.	H_s	H	H	
2	17.0	H	Corn	Pot.	H_s	H	
3	14.0	Pot.	H_s	H	H	Corn	
4	16.0	H	H	Corn	Pot.	H_s	
5	14.0	H_s	H	H	Corn	Pot.	
6	10.0	Long Term Pasture					

Potatoes (pot.)	14.0	16.0	17.0	16.0	14.0	
Corn	16.0	17.0	16.0	14.0	14.0	
Hay (H)	47.0	44.0	44.0	47.0	49.0	
Cropland	77.0					
Pasture	10.0					
Homestead and Lanes	2.0					
Woodlot	6.5					
Total Acreage	95.5 ac. (approx.)					

Schooley

The objectives of this farm plan were to arrange a definite cropping program, and to increase the production while trying to maintain soil productivity at an economically high level. The land was mostly a sandy loam soil, with a few areas of clay loam.

In making up the new plan, the type of farming was kept in mind, that is potatoes, corn, and hay or pasture in rotation. The fields were rearranged to be as convenient as possible to the buildings and to give a balanced rotation of these crops. One field near the buildings was put in long term pasture, and permanently fenced. The only other fences are around the woodlot and the one straight back through the farm where the lane used to go. As this farm needed a large proportion of sod for hay and pasture, it didn't need a general soil build-up plan as much as it needed an organized cropping system.

A fertility program was discussed with the farmer. The main requirements for additional commercial fertilizer being recommended from soil samples that were tested at the Soils Laboratory. The proper handling of manure and crop residue was also introduced into this farming system.

Although the farm is not too hilly, and the cropping system isn't too conducive to erosion, nevertheless, there were some gullies and soil erosion resulting from the past cropping system. Grassed waterways were recommended where these gullies demanded it, and the new rotation will cut the soil erosion on the slopes down to a minimum.

CHAPTER 7

RECOMMENDATIONS

The study of Upper Black Creek reveals that a number of things might be done to improve the general land use picture of this valley. Most of the improvements can and should be carried out by the individual farmer but there are some which may be beyond the individuals' financial or technical capabilities. In these instances there is a public interest which might often be fulfilled through participation by the Conservation Authority. At times this participation may be limited to technical assistance; at other times more tangible and direct assistance may be needed.

Members of the farm community are sometimes unaware of the considerable assistance available to them in the solution of their difficulties and problems in relation to the farm enterprise. This aid may be provided by the Conservation Authority, Agricultural Representative, Zone Forester, and the local municipal council. Often commercial agencies working in agriculture and supplying farm needs can provide advice in specific cases. The Conservation Authority can provide a beneficial service through publicising the sources and kind of aid which farmers may receive, by assisting in the solution of individual problems where this seems desirable, and by setting up demonstrations of good land use practices and control measures.

As suggested above, most of the land use improvements may, if such is not already the case, be carried out by the individual farmer. These practices are fairly numerous but not all of them will necessarily be useful or desirable on any one farm. The need for any or all of these measures will be indicated in a farm plan and it is recommended that the Authority, with the advice and assistance of the Agricultural Representative, promote land use planning on each farm in the valley.

Runoff channels like this one should be left permanently in grass.

Gullies are fairly common in the watershed and steps should be taken to control them.

Some of the conservation practices which would find particular application and value in the valley include those of gully control, farm ponds, grassed waterways, private reforestation, pasture improvement, farm drainage, stream channel control, crop rotations, and mulching and weed control. Brief comments on some of these follow. The order does not mean to suggest relative importance.

(a) Gully Control

Gullies develop for many reasons but probably the principal cause is the accelerated run-off produced by uncontrolled grazing of grasslands and imperfect methods of cultivation. Land cultivated and put to crop should be protected from excessive run-off and gully erosion through the use of grassed waterways, through contour cultivation and strip cropping where possible, and by maintaining the tilth and absorbency of the soil.

Where gullies have already developed their renovation may be difficult and each must be considered as an individual case. A number of gullies exist on the watershed and because they can deteriorate rapidly and soon remove good agricultural land from use, these should be taken out of use immediately and a program of control instituted. Primarily, this is a job for the individual farmers on whose lands they lie, but there is also a public interest involved and the Authority should take an active interest in their control.

(b) Grassed Waterways

There are many cultivated fields on the watershed where farmers find washouts occurring in drainage courses after heavy rain. These are possible gullies of the future and are logical places for the construction of grassed waterways. These waterways may require widening and grading, after which they should be fertilized and seeded down to a densely-growing, thickly-rooted grass mixture. The waterway should be liberally wide and can often provide good hay and

pasture as well as performing its prime function of water control. If used for pasture the grazing should be controlled to prevent deterioration of the waterway.

Grassed waterways may, in most instances, be constructed using the farmer's own machinery. The main essential is that there be a desire on his part to do the job. The Authority may do much to foster this interest, perhaps by a partial subsidy or the provision of special machinery where it is needed.

(c) Private Reforestation

There are no areas in the valley large enough to warrant acquisition by the Authority for an Authority Forest, but there are a considerable number of small parcels which could and should be reforested and maintained privately. Most of these parcels are situated on the steeply-sloping banks of the creeks where erosion has taken its toll. The Authority should assist owners in planting these areas and should strongly encourage such planting. Some of those areas mapped as classes VI and VII on the Recommended Land Use map should be returned to forest.

(d) Farm Drainage

A significant acreage of the watershed suffers from imperfect soil drainage and crop production is made more difficult because of it. Although the Authority does not have any direct responsibility for farm drainage, these responsibilities being met in the various Drainage Acts, it does have an interest in promoting the advantages of farm drainage and in seeing that certain aspects of it are properly done. This interest would not be defined in legal terms but in publicity and education.

Of the two types of drainage, ditch and tile, the latter is the most important although generally the more expensive to install. Under The Tile Drainage Act a farmer may obtain low cost loans from the Province through his township for 75% of the cost of the work up to $3,000 per 100

acres or fraction thereof. These loans run for a period of 10 years but the farmer may pay them off at any time and experience has shown that adequate tile drainage frequently pays for itself in higher crop yields and lower operating costs in 2 or 3 years. The drains thus pay handsome dividends during the many years of their life.

Under its land use program the Authority may take an interest in promoting adequate farm drainage and also of satisfactory drain outlets. Many gullies in the Province have started because adequate precautions were not taken to ensure that the tile outlets were provided with headwalls and splash aprons.

(e) Farm Ponds

In recent years irrigation of crops has become an essential feature of portions of our farm economy. This is especially true in some areas of specialized production such as the Norfolk tobacco belt. Irrigation is not restricted to the high-value specialized crops however, and some farmers in the Province are using it as a means of increasing the productivity and quality of general crops like pasture.

In the Upper Black Creek Watershed there is a combination of the intensive and more general farming. For satisfactory production both require good supplies of water. In an area such as this valley where surface water supplies are not always satisfactory the need may often be met by farm ponds. Such ponds may supply water for irrigation, stock, fire protection, spraying and recreation. For satisfactory use and long life these ponds - of whatever type - should be properly built and maintained. Although the Authority no longer provides a direct subsidy for pond construction it does provide engineering assistance and can, consequently, through this means and through education and publicity, guide farm pond construction so that each pond will operate satisfactorily for the longest possible time.

(f) Stream Channel Control

Stream bank erosion is not, generally, a great problem in the watershed, but there are sections of the stream which should be watched and, if necessary, remedial control measures taken. A major problem in this regard is allowing cattle to trespass on the stream and trample the banks and pollute the water. The Authority may, at times, find it desirable to assist in stream bank grading and planting and in channel straightening.

Although the Authority may do much to promote good land use in the valley by providing aid in worth-while individual projects and by demonstration, perhaps the greatest good will be accomplished in the long run through education and publicity. The Authority should, therefore, work as closely as possible with farmers' organizations in/or respecting the valley and with the young folk in their schools. These young people are usually quite enthusiastic about things such as tree planting days, school conservation scrapbooks and so on. It should be remembered, too, that they are the farmers and citizens of tomorrow and will have a great deal to say about the manner in which our land is used.

A major endeavour of the Authority should be the promotion of land use planning on the individual farms in the valley. Much that the Authority will want to accomplish in the field of improved land use in the years ahead will come about through farm plans. Initial progress in this matter will, without doubt, be modest, but quiet persistence will bring results. Farm planning is worth while and does pay for itself if properly carried out. It is therefore urged that the Authority, with the assistance and advice of the Agricultural Representative, explore ways and means of encouraging farmers to have their farms under plan.